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# FOREST PEST MANAGEMENT
# Pacific Southwest Region

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3420 Biological Evaluation

## AN EVALUATION OF TREE MORTALITY IN THREE SPOTTED OWL HABITAT AREAS ON THE HAT CREEK RANGER DISTRICT, LASSEN NATIONAL FOREST

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### ABSTRACT

Tree mortality in three Spotted Owl Habitat Areas (SOHAs) on the Lassen National Forest was evaluated to develop pest management alternatives for consideration in vegetative management prescriptions for these areas. The evaluated SOHAs were: West Prospect, Cow Creek and Upper Bunchgrass. Dendroctonus beetles are the primary pests causing the observed damage in the West Prospect SOHA. Fir engravers and Cytospora canker are the major pests in the Cow Creek and Upper Bunchgrass SOHAs. Two alternatives, namely, No Action and Vegetation Management directed toward maintaining tree and stand vigor, while providing for the continued availability of spotted owl habitat, are discussed.

### INTRODUCTION

On November 9, 1988, Dennis Hart, Entomologist from the Forest Pest Management Group, accompanied Ray Corbin, Forest Technician; Tom Simonson, Forest Silviculturist; and Wildlife Biologists Gary Smith and Boyd Turner of the Lassen National Forest, on an evaluation of tree mortality in three SOHAs on the Hat Creek Ranger District. West Prospect, Bunchgrass and Cow Creek SOHAs were observed. Only the West Prospect SOHA was evaluated in sufficient detail to provide an in depth biological evaluation. The continued availability of spotted owl habitat and nest trees in these three SOHA's is critical to maintaining the Region 5 network for viability of this sensitive species. Thus, pests that threaten the existence of trees suitable for spotted owl habitat and nest sites, and affect the general vigor of stands within the SOHAs, are critical to vegetation management activities directed toward providing habitats favorable for these birds.

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## OBSERVATIONS

West Prospect SOHA. The stands in this area are two-storied, with 300+ year-old ponderosa, Jeffrey and sugar pine, and white fir, plus a scattering of incense-cedar in the overstory. White and red fir, and ponderosa and Jeffrey pine make up the understory. Ponderosa and Jeffrey pine comprise at least 80% of the overstory, while white fir comprises at least 70% of the understory. The site quality is moderate to low.

In stands where high levels of tree mortality is occurring, total stand basal area averages 400 $ft^2$ per acre, which is 110% of normal basal area (Dunning and Reineke). This level of stocking is extremely high and indicates that these stands are at risk to pest-caused damage. Only overstory pine and white fir are dying. Overstory basal area in the stands where tree mortality occurs ranges from 200 to 320 $ft^2$ per acre. In these stands 20 to 100% of the overstory trees are dead or dying. Understory basal area in these stands ranges from 120 to 300 $ft^2$ per acre.

The bark beetles causing tree mortality in these stands are the western pine beetle (Dendroctonus brevicomis), mountain pine beetle (Dendroctonus ponderosae), red turpentine beetle (Dendroctonus valens), and the fir engraver (Scolytus ventralis). Fir mortality caused by the fir engraver was associated with other pests. These associated pests were root disease, dwarfmistletoe and Cytospora canker.

There is no tree mortality in the understory component of these stands or in stands with total basal areas less than 300 $ft^2$ per acre.

The overstory pine trees that are being attacked by bark beetles are not producing pitch tubes on their upper boles as they usually do during periods of normal moisture. In many instances, the only external evidence of bark beetle attack on affected trees is pitch tubes at the root collar caused by Dendroctonus valens. However, when these trees were more closely examined, attacks by western and mountain pine beetles were usually evident. The absence of pitch tubes indicates that these trees are seriously stressed by overstocking and drought. Ordinarily, pine trees will form pitch tubes when they are attacked by bark beetles and, in healthy trees, this pitch will overwhelm and kill the attacking beetles. In these stands, however, the attacked trees have no defense against the beetles due to severe moisture stress.

Elytroderna needle disease is severe enough to affect the vigor of some of the most heavily infected pine trees.

Cow Creek SOHA. The stands in this area are two-storied, with red fir being the primary tree species in both components of the stands. This area is composed of mosaics of stands; some are vigorous and some are not because they are severely overstocked. Many of the red fir trees in these stands, both in the under and overstory, are infected with Cytospora canker (Cytospora abietis). During periods of severe stand stress caused by overstocking and

We cannot do much about the drought, but we can reduce stand stress due to overstocking.

In young growth eastside pine stands, Fiddler, Hart and McDonald (1988) found no tree mortality in their study plots at basal areas less than 50% of normal. Oliver (1979) showed that the optimum stocking level of eastside pine stands is about 55% of normal, implying that mortality below this level of stocking was minimal. Hart and Fiddler (1986) showed that when these stands approach 75% of normal, endemic bark beetle mortality begins. When the basal area reaches 90% of normal, bark beetle mortality intensifies and increases as the stand basal area increases. Periods of stress, such as the drought experienced over the last two years, will further impact these stands and predispose them to increased risk of bark beetle attacks. Case studies in the Level of Growing Stock investigations conducted by silvicultural research in young growth fir stands verify these general results. Therefore, thinning should be effective in relieving stand stress and maintaining the health and vigor of the stands. A given site can only support a given amount of vegetation.

## Management Alternatives

1. No Action. Bark beetle-caused tree mortality will continue. If the drought ends this year, tree mortality will eventually subside. It will increase again in the future, however, due to stand stresses caused by overstocking. Without reducing this stress, the overstory component of these stands can only be maintained for about 50 years. This is not a long enough period of time to develop the understory component of these stands into suitable spotted owl habitat. Therefore, this is not an acceptable management alternative if the West Prospect area is to be maintained as a SOHA.

2. Vegetation Management. The only way to maintain the continued availability of spotted owl habitat and nest sites is through vegetation management activities directed toward providing favorable habitats for these birds. Trees do not live forever, therefore, provisions must be made for maintaining for as long as possible the thriftiest of the overstory component, while at the same time, providing for the replacement of suitable habitat and nest trees for spotted owls. Management activities directed toward maintaining tree and stand vigor, considering the habitat requirements of spotted owls, will preserve the present habitat trees for as long as possible as well as allow for the recruitment of new trees into older classes.

a. Salvage Green-Infested Trees. This will not relieve stand stress due to overstocking, but if salvage is used in conjunction with thinning and proper slash treatment, it can be effective in reducing bark beetle impact in the affected stands. Green-infested trees must be removed from the SOHAs before the bark beetle broods emerge. Removing bark beetle infested trees alone will not affect subsequent tree mortality in these areas, as this mortality is dependent on the stand stresses affecting the vigor of these trees. Under the present conditions, salvaging green-infested trees in the spring, with thinning in the fall will not significantly reduce tree mortality over thinning alone.

b. Thin Overstocked Stands. Only those stands within the SOHAs that are seriously overstocked should be thinned. Stands which are 90%+ of normal basal

drought, Cytospora canker can predispose host trees to damage by Scolytus beetles.

Upper Bunchgrass SOHA. The stands in this area are two-storied and are composed primarily of red fir. Both the understory and overstory are heavily infected with Cytospora canker. Some of these stands were thinned, primarily from below, to relieve stress from overstocking. The residual overstory trees are vigorous, but Cytospora canker has developed rapidly through the stands following thinning. This will seriously affect the future vigor of these stands.

## DISCUSSION

Unacceptable levels of bark beetle-related tree mortality are occurring in the West Prospect SOHA because of the interaction of overstory stand age, site quality, levels of stocking and reoccurring drought; the overstory component of this area will likely die over the next few decades. The understory component of these stands cannot reasonably be expected to replace the overstory component as it dies. The overstory trees are required for spotted owl habitat and nest sites. If the overstory component of the stands dies without replacement, the area cannot function as a SOHA for several decades. The only way this SOHA can function in perpetuity is if stand stress is relieved through vegetative management practices. No trees live forever, even at low levels of insect and disease activity. Management directed toward maintaining overstory trees and overall stand vigor will attempt to preserve the present spotted owl habitat and nest sites for the longest possible time as well as allow for the recruitment of new trees into these older classes. The most effective vegetative management practices for maintaining stand health, vigor and growth are thinning and sanitation. Salvage of currently green, beetle infested trees alone will do little to perpetuate or enhance the SOHA.

In areas where the understory pine component is overstocked, it is probable that it will eventually suffer tree mortality caused by the mountain pine beetle.

Although available stocking studies only refer to carrying young-growth stands through to rotation, the same general principles apply to old-growth stands. Most of the existing normal basal area tables were developed in old-growth stands. In theory, normal basal area is the maximum stocking a given site can support, but in reality stands can be overstocked without exceeding normal basal area. If stands exceed this basal area, whether young or old-growth, they are overstocked. Bark beetles frequently exploit overstocked stands and cause serious impact. The stands in the West Prospect SOHA where serious tree mortality is occurring are overstocked. Therefore, overstocking is one of the major factors associated with tree mortality in this SOHA. The trees that are dying are the trees that make the best spotted owl nest trees. The trees that are surviving best in these stands are trees highly unsuited to function as nest trees for the spotted owl now and for many decades into the future. The best way to insure that this area can continue to function as an effective SOHA is to treat factors contributing to tree mortality in this area. There are two main stresses contributing to this tree mortality--drought and overstocking.

area should be considered for thinning. The understory of stands to be thinned should be reduced to 55 to 60% of normal basal area. Thinning should be from below. Trees that meet the requirements for spotted owl habitat and nest trees should be favored to save, according to their relative health and vigor, because low vigor trees are favored for attack by bark beetles. The probability for successful attack and colonization by bark beetles is directly related to the relative health and vigor of the trees. Trees in the understory that should be favored to save are trees which will develop into acceptable habitat and nest trees in the shortest period of time. Thinning will increase the health and vigor of these stands and increase the growth rate of the understory trees, reducing the time required to produce acceptable habitat and nest trees. Localized clumps of trees should also be favored in areas where it is determined this will enhance spotted owl habitat. Because noise and disturbancess in the stand are detrimental to spotted owls, there should be no logging activity within one quarter mile of spotted owl base habitat.

c. Sanitize Stands. Thinning is effective in relieving stand stress due to overstocking, but to help maintain the health and vigor of the stands, they should also be sanitized. In red fir stands infested with Cytospora canker, the disease appears to spread rapidly through the stands after thinning. To reduce the risk of this occurring, trees with 20% or more of their crown infected with Cytospora canker should be removed.

Because Elytroderma needle disease reduces the vigor of infected trees and predisposes heavily infected trees to bark beetle attacks, select against trees with more than 40% of their crowns infected with this needle disease.

d. Borax Stump Treatment. This alternative should be used in conjunction with any combination of a, b, and c above to reduce the risk of introducing annosus root disease into the treated stands. Spread of annosus root disease can be favored by thinning because many fresh stumps are produced. These stump surfaces can serve as infection courts for this fungus. To prevent stump infection and subsequent spread of this root disease, stump surfaces, both pine and fir, should be treated with borax within 4 hours after they are cut. Stumps less than 8 inches in diameter, when created during the summer, usually do not require borax treatment because high temperatures are lethal to the fungus.

e. Slash Treatment. Slash treatment is recommended in conjunction with thinning because of the rapid buildup of heavy fuel loading and the potential of serious damage occurring in the residual stand from engraver populations which can develop in the green slash. Because engraver beetles can complete their development in about a month under ideal conditions, treatment should be carried out soon after cutting to be effective. Utilization of the cut material to the smallest possible diameter will minimize the amount of breeding material available to these beetles. Engraver broods require green stem and branch material 3 inches in diameter and larger to successfully develop. The timing of woods operations to incur minimum risk of sustaining stand damage from pine engraver beetles is from mid-July through the end of December, when the green slash has a high probability of drying out, heating up, or spoiling before the engraver beetles can complete their development. If woods operations are required outside this time period, measures must be taken to prevent the the emergence of bark beetles which can damage trees in the residual stands. The season of high risk for woods operations in relation to pine engraver

beetles is from the first of February through mid-July. The period of high risk for damage by fir engraver beetles is from the first of March through the first of October.

If green-slash must be created during the seasons of high risk, slash treatments are available to prevent the buildup of engraver beetle populations. Slash treatment methods which generally work well include chipping, lopping and scattering slash in sunny areas to dry it out, crushing or mashing slash with logging equipment to make it unsuitable for engraver breeding, or piling and burning the slash within a month of cutting. Broadcast burning the slash might work if it could be done without damaging the residual stand. A method which has worked during the summer in hot climates is to pile slash in a sunny area and tightly cover the pile with clear plastic. If the temperature under the bark of slash in all parts of the pile reaches 120°F, all broods currently in the pile will be killed. Because most engraver beetle attacks occur within a quarter-mile from the location where the beetles emerged, high value trees can be given some protection by removing fresh slash to areas which do not have pines. Two practices which should generally be avoided are piling fresh slash without further treatment, and allowing slash to touch or remain near valuable leave trees.

A serious problem with the lopping and scattering method of slash treatment, is that in most woods operations, the slash is not reduced to fine enough pieces to dry out before the engraver beetles emerge.

No green-slash material larger than 3 inches in diameter (either stem or branches) should be left in the treated stands. Green logging slash should be yarded to landings and burned before broods of insects can emerge from this material and endanger the residual stands. This will also protect the stands from fire injury by keeping the slash piles to be burned a safe distance from residual trees in the stands.